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## THE PATENT OFFICE

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### Cigarette Paper and Method of Making It

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1 Our invention relates to cigarette paper and more particularly to improving the burning characteristics of cigarette paper when associated with tobacco as in the usual cigarette.

One commercial problem in the manufacture of high quality, inflammable cigarette paper is to obtain a paper that will have the proper burning rate when it is in contact with tobacco, such as in a cigarette, and will produce an ash of the type described below. The desire in the majority of the domestic type cigarettes is to have the paper burn at or about the same rate as the tobacco which is in close proximity to the paper. And a desirable paper ash is one that has a minimum of carbonized or incompletely burned residue and possesses sufficient cohesion with the tobacco ash to remain in intimate contact therewith while being formed. Such results have not heretofore been fully attained, since the prior cigarette papers burn either too slowly or too rapidly, or have other inherent properties that prevent the formation of the desired type of ash.

If the burning rate of the paper is too slow, the tobacco burns ahead of the paper and thereby causes smothering of the cigarette unless a forced draft is maintained to keep it burning. Conversely, if the cigarette paper burns too fast, the paper is consumed ahead of the tobacco and at too low a temperature for complete combustion. This results in the formation of carbonized paper particles or black, curling ashes which flake off and fall from the cigarette onto the smoker's clothing. This is a nuisance since the black ash soils the smoker's clothing. Furthermore, it is annoying to the smoker because he must be continually vigilant of this black, falling ash and attempt to prevent it from falling onto his clothing.

Heretofore, burning rates of cigarette paper have been controlled generally by porousness of the paper. In turn the porousness has been controlled by the amount of filler present, such as calcium carbonate, and by various mechanical treatments of the fibre and paper web. Also, numerous chemicals and fillers and combinations thereof have been incorporated in the sheet in various manners. For example, sodium and potassium nitrates have been used in cigarette paper to give certain burning effects but they produce a solid, hose-like, self sustaining ash, which is artificial in appearance and has not been acceptable to many

2 cigarette manufacturers and smokers. Furthermore, the use of such types of chemicals in smoker's products is undesirable. The use of glass fibres produces a similar ash to that obtained with the nitrates. Also, chemicals like tungstates and borates have been used to produce a non-combustible type of paper which cause the cigarette to be self-extinguishing when used in the recommended amounts.

We have discovered that markedly improved burning properties of cigarettes may be obtained by applying to or introducing in the cigarette paper the type of chemical composition described below. It effects a completely burned, uniform, gray-white ash that merges with the tobacco ash and appears as an integral part thereof. This ash is not of the artificial, hose-like, completely self sustaining structure mentioned above. And it has the desirable property of being flaky and easily disintegrated at the smoker's wish but yet sufficiently cohesive to prevent continuous, accidental falling onto the smoker's clothing. Furthermore, it is free of the numerous black curling particles that characterize the incompletely burned cigarette paper ash.

The composition that provides the desirable burning or ashing properties in the cigarette paper characteristic of our invention contains an aqueous solution of ammonium phosphate and preferably also ammonium sulfate, in regulated amounts. The ammonium phosphate may be either mono or di ammonium phosphate or both. The aqueous solution of ammonium phosphate may be used alone to regulate the burning rate of the cigarette paper and substantially avoid the formation of the black curling ashes, above described. To obtain this result most efficiently and to produce the optimum appearance in the cigarette paper ash we have found it advantageous to use both the ammonium phosphate and ammonium sulfate.

Our composition may be applied to the paper by immersion, spraying, coating or size press impregnation. For certain commercial applications we have found it advantageous to apply the composition at the size-press of the paper machine, to the partially dried paper web. In general, the application may be made at any point on the paper machine. Also, if desired, the composition may be applied to dry or substantially dry paper, either at the end of the drying section of the

3

paper machine or as a separate operation on finished paper. However, we have found it of definite advantage to apply the composition to fairly wet paper, or paper containing a substantial moisture content. The moist paper is conducive to more uniform impregnation thereof by the composition and also permits greater concentration of chemicals in the aqueous solution which is applied to the paper, thereby effecting an economy in drying.

The proportions of the chemical composition containing ammonium sulfate and ammonium phosphate may be varied, and one or more phosphates may be used. Best results have been obtained when the sulfate and phosphate salts are present in substantially equal proportions, but these may be varied to provide a 40%-60% ratio of either component. And even outside of this range, beneficial effects will be obtained. When the aqueous solution of ammonium phosphate is used alone for addition to the wet paper the amount of ammonium phosphate, on a dry weight basis, may vary from about 2/10% to 4/10%, expressed as  $\text{PO}_4$ . When the aqueous solution of ammonium sulfate is also used along with the aqueous solution of ammonium phosphate, the amounts of these two compounds, on a dry weight basis, may vary from about 2/10% to about 4/10% for the ammonium phosphate, expressed as  $\text{PO}_4$  and about 0% to about 32% for the ammonium sulfate, expressed as  $\text{SO}_4$ .

In commercial practice we have obtained good results with a composition that contains the following ingredients and proportions:

Ammonium sulfate	50%, e.g. 1.57 pounds
Mono ammonium phosphate	40%, e.g. 1.25 pounds
Di-ammonium phosphate	10%, e.g. 0.31 pound
Water	50 gallons

This aqueous composition forms a true solution and is practically water clear. It will serve to treat, by size press application, a running moist web of cigarette paper for sufficient time to produce 500 pounds of treated paper having a weight of about 21 grams per square meter of paper.

Substantially equivalent results have been obtained with two other compositions similar to the above. In one of these compositions mono ammonium phosphate is the only phosphate used and is present in substantially equal amount with the ammonium sulfate; and in the second instance di-ammonium phosphate alone is used in like amount.

A composition containing the ammonium phosphate alone in aqueous solution, which we have used with good results is as follows:

Mono- or di-ammonium phosphate	1 1/2 pounds
Water	50 gallons

A typical embodiment of our invention is cigarette paper made from flax or other vegetable fiber pulp, and calcium carbonate filler, as basic constituents, and impregnated with the chemical substances described.

The finished paper of our invention, when used as a cigarette wrapper, has characteristics that definitely identify it, and show marked improvement over cigarette paper heretofore available as referred to hereinbefore. Burning cigarettes using our new paper produce a smooth, uniform, grey-white ash, as contrasted with conventional cigarettes that produce a rough or irregular, blackish ash. Also our new paper, upon burning, tucks into the fire zone of the cigarette tobacco ash and adheres to the tobacco ash. This is distinctly

4

different from conventional cigarette paper, which commonly curls out away from the fire zone and produces the objectionable, black, carbonized fly ash, above described.

The percentages given hereinabove for the ammonium phosphate when used alone, and for the ammonium phosphate and ammonium sulfate when used together, provide the desired ashing properties in the cigarette paper but do not adversely affect the combustibility of the paper.

#### Supplementary Disclosure

It has been found that, if amounts of less than 0.1% of ammonium phosphate (expressed as  $\text{PO}_4$ ) are used in the paper, the desired ashing properties are not obtained; and when amounts of ammonium phosphate substantially above 1% are used, some undesirable charring and fireproofing effects occur. The percentage range 0.1% to 1% of ammonium phosphate is therefore considered to be the best practical operating range. While the original disclosure is of a breadth which includes the range just mentioned, it does not specifically mention this practical operating range, so that the range could not be properly mentioned in the claims. The presentation of this Supplementary Disclosure overcomes this handicap, and the practical operating range is mentioned in the appended claims which are supported by this Supplementary Disclosure.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A combustible, cellulose, cigarette paper having improved ashing properties when burned as the wrapper on a cigarette and containing throughout, a carbonate filler and ammonium phosphate in an amount of approximately 0.2% to 0.4% phosphate (expressed as  $\text{PO}_4$ ) which does not adversely affect the combustibility of said cigarette paper wrapper on a cigarette, but upon burning of the cigarette causes the paper to produce a completely burned, uniform, flaky, gray-white, non-falling ash that merges with the tobacco ash and adheres thereto uniformly and continuously throughout the length of the burned cigarette.

2. A combustible, cellulose, cigarette paper having improved ashing properties when burned as the wrapper on a cigarette and containing throughout, a carbonate filler and ammonium phosphate in an amount of approximately 0.2% to 0.4% phosphate (expressed as  $\text{PO}_4$ ) and 0.0% to 0.32% ammonium sulfate (expressed as  $\text{SO}_4$ ), which does not adversely affect the combustibility of said cigarette paper wrapper on a cigarette, but upon burning of the cigarette causes the paper to produce a completely burned, uniform, flaky, gray-white, non-falling ash that merges with the tobacco ash and adheres thereto uniformly and continuously throughout the length of the burned cigarette.

3. A combustible, cellulose, cigarette paper wrapper containing throughout the cigarette paper wrapper, a carbonate filler and approximately 0.2% to 0.4% ammonium phosphate (expressed as  $\text{PO}_4$ ) that causes the wrapper upon burning on the cigarette to produce a grayish-white, flaky, cohesive ash throughout the length of the cigarette, which is characteristically free of curling black particles and tends to adhere to the cigarette ash and not fall upon the smoker's clothing.

4. A combustible, flax fiber, cigarette paper wrapper containing throughout the wrapper, a carbonate filler and approximately 0.2% to 0.4% ammonium phosphate (expressed as  $\text{PO}_4$ ) that

causes the wrapper upon burning on the cigarette to produce a grayish-white, flaky, cohesive ash throughout the length of the cigarette, which is characteristically free of curling black particles and tends to adhere to the cigarette ash and not fall upon the smoker's clothing.

*Claims Supported By Supplementary Disclosure*

5. A combustible cigarette paper wrapper consisting of cellulose fibers, carbonate filler, and approximately 0.1% to 1% ammonium phosphate (expressed as  $\text{PO}_4$ ) that causes the wrapper upon burning on the cigarette to produce a grayish-white, flaky, cohesive ash which is characteristically free of curling, black particles and tends to adhere to the cigarette ash and not fall upon the smoker's clothing, said ammonium phosphate alone producing these desirable properties in the cigarette paper ash and yet not retarding the combustibility of the paper or otherwise affecting the

igniting properties of the ash on the burning cigarette.

6. A combustible cigarette paper wrapper consisting of cellulose fibers, a carbonate filler, and approximately 0.1% to 1% ammonium phosphate (expressed as  $\text{PO}_4$ ).

7. A combustible cigarette paper wrapper as defined in claim 6, in which the carbonate filler comprises calcium carbonate.

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